Appendix C

WATER BALANCE ASSESSMENT

CLIENTS | PEOPLE | PERFORMANCE

Boral Recycling Pty Ltd

Report for Greystanes Estate SEL Subdivision

Widemere East Water Balance Assessment

August 2007

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. Introduction

1.1 General

The following report is a preliminary investigation into the water balance strategy for the proposed industrial development at Greystanes Estate Southern Employment Lands site (SEL site).

A number of studies have been undertaken to investigate stormwater management at the site, and findings of which are reported in the following key documents:

- Review of Stormwater Detail Design Report December 2006 (GHD June 2007); and
- Groundwater Drainage Design Report (GHD July 2007).

These reports are referred to herein as the “previous studies”.

The site area is approximately 160 ha, of which 65 ha of land is considered to be developable land. This land will be developed for employment uses.

1.2 Objectives

The key objectives of this report are to investigate opportunities to harvest stormwater from the site for transfer to the Cumberland Country Golf Club (CCGC).

In general, it is proposed that runoff from the site be collected in a balancing pond to be located on Boral lands at Widemere East and re-used to irrigate the golf course. It is understood that the minimum demand for water to be transferred to the golf course is 58 ML per year with the CCGC utilmate deand closer to 130ML per year, based on estimates provided by the CCGC. It is understood that this volume is not the actual irrigation demand of the golf course, but is equivalent to the volume of potable water savings the CCGC need to achieve from the Sydney Water supply system in order to maintain government funding. The transferred water would be stored in a number of dams within the golf club property.

2. Assumptions

The following assumptions were made for the analysis:

- The minimum demand to be transferred to the golf course is 58 ML/year;
- Catchment areas and impervious percentages were used from available information for the SEL site;
- Ground water was incorporated in the model as a constant inflow of 0.24L/s. This was taken from a Groundwater Drainage Design Report (GHD, July 2007);
- It is assumed for the purposes of the simulations that the pumps are operating continuously for 24 hours a day, seven days a week;
- Evaporation was not considered in this preliminary model as it is understood that the intent is to maximise transfer of the water from the balancing pond to the golf course using a continuous pumping operation. This implies that the basin will be subject to rapid draw down, and as such there is limited opportunity for evaporation; and
- It is assumed that the golf course can store an unlimited volume of water on site.

3. Methodology

3.1 Model

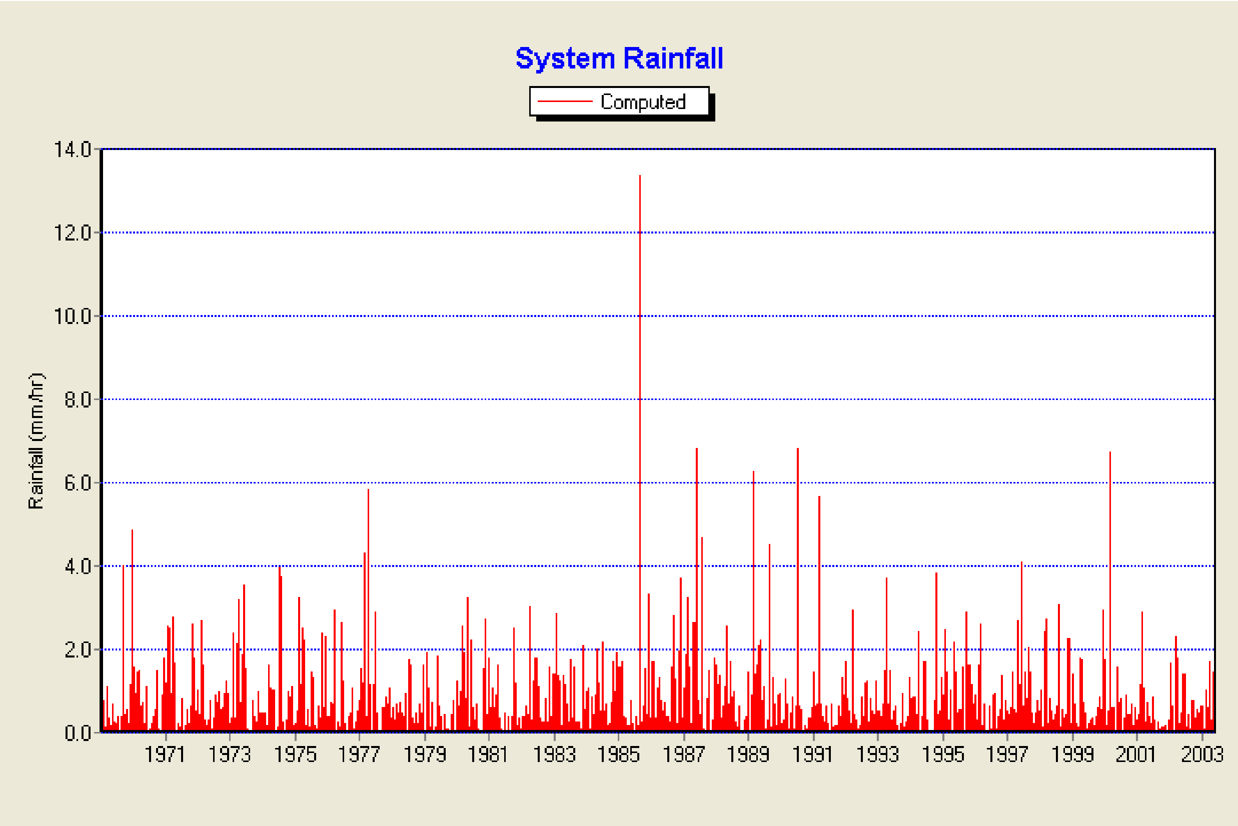
An EPA SWMM model was compiled for the site. The model was configured to simulate at a daily time step for approximately 35 years of rainfall data. The model was based on the catchment areas draining from the SEL site and a balancing pond was configured for collecting the stormwater runoff. It is important to note that the model did not consider diurnal demand distributions (peak demands were averaged over the day).

3.1.1 Input Data

Daily rainfall data for the simulation was obtained from the Bureau of Meteorology (BOM). The nearest rainfall station was Prospect Reservoir (# 067019), which provided data for the period from 01/02/1887 to 30/04/2004. Given the long simulation time associated with more than 100 years of rainfall data, only data from 1970 to 2004 was used for the simulations.

The rainfall data used for the simulations is for Prospect Dam, which is located near to the site. In order to provide a regional result comparison, rainfall data from Winston Hills (station 067080) was used to provide a range of results. The range of results is shown the graphs in section 4.

Figure 1 Rainfall Data – Prospect Reservoir (#067019)



3.1.2 Model Arrangement

To simplify the modelling and respond to the site catchment areas; the model was aggregated into five main sub-catchments which represent the entire proposed SEL development site (refer Figure 2). For concept layout refer to section 5.

Figure 2 Model Configuration

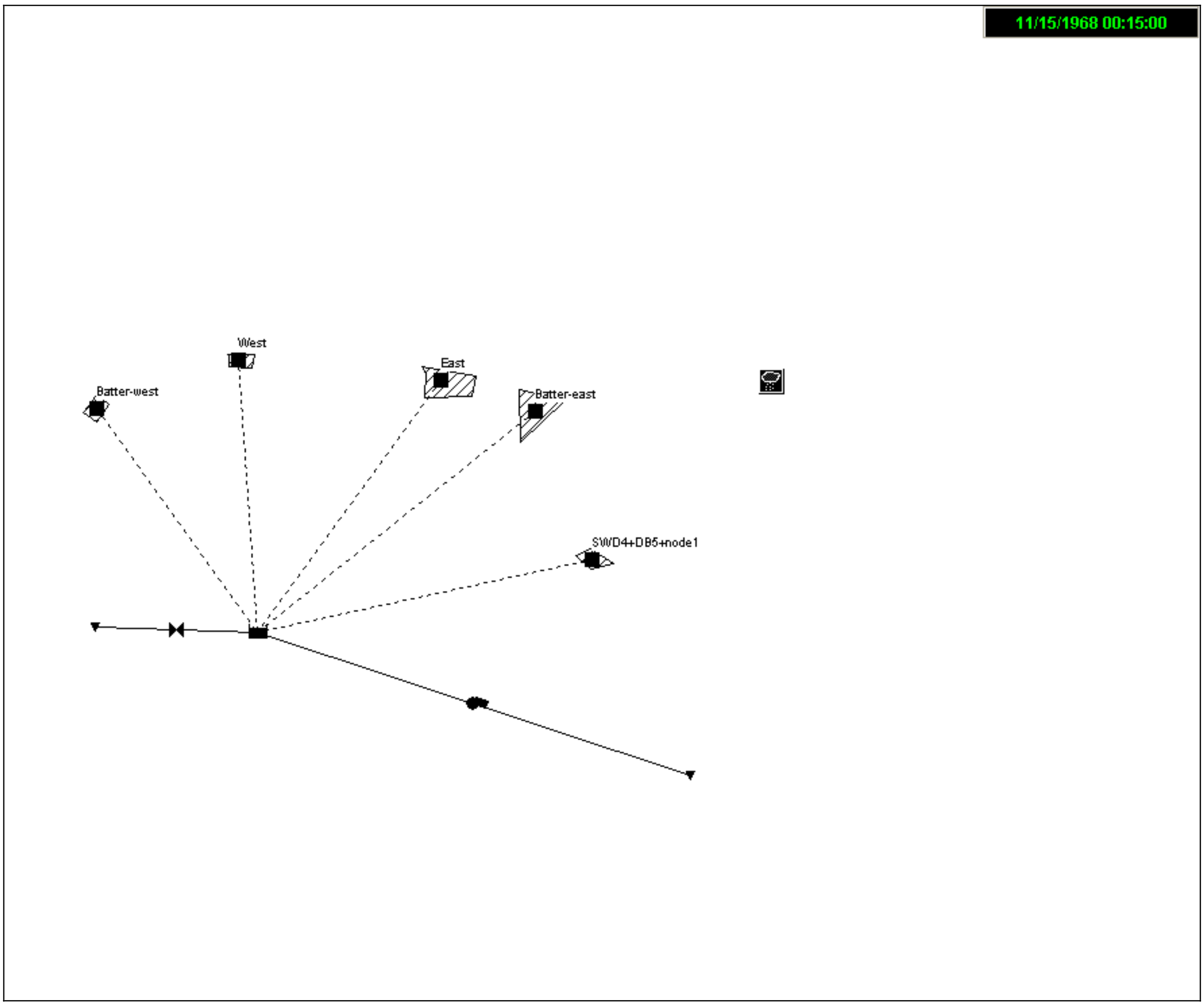


Table 1 Model Arrangement

Area	Description	Area (ha)	Impervious Percentage (%)
Batter West	Batter West represents the western batter for the site.	11.1	70
West	This catchment represents the aggregate of the western catchments for the site	22.8	85
Batter East	Batter East represents the eastern batter for the site.	17.5	70

Area	Description	Area (ha)	Impervious Percentage (%)
East	This catchment represents the aggregate of the eastern catchments for the site	49.2	85
Other	This catchment represents the remainder of the site draining to the Widemere basin area and the Spine Rd/Transitway.	19.3	30

Note approximately 40ha of the Boral lands surrounding the site does not drain to the Widemere East Basins.

Runoff from the catchments is transferred to the balancing pond from where it is pumped to the Cumberland Country Golf Club. An overflow weir was configured for instances when the balancing pond was full and overflow occur.

4. Results

4.1 Simulations

Two scenarios were considered for the simulations, as follows:

- Scenario 1: Constant pump rate and increasing balancing pond volume; and
- Scenario 2: Constant balancing pond volume and increasing pump rate.

Table 2 below lists the options simulated in the model.

Table 2 SWMM Simulations

Option	Storage Volume (ML)	Pump Rate (L/s)
1	25	1.84 (equates to 58 Ml/year)
2	10	1.84
3	5	1.84
4	3	1.84
5	2	1.84
6	1	1.84
7	1	5
8	1	7
9	1	9.3
10	3	5
11	3	7
12	3	9.3
13	5	5
14	5	7
15	5	9.3

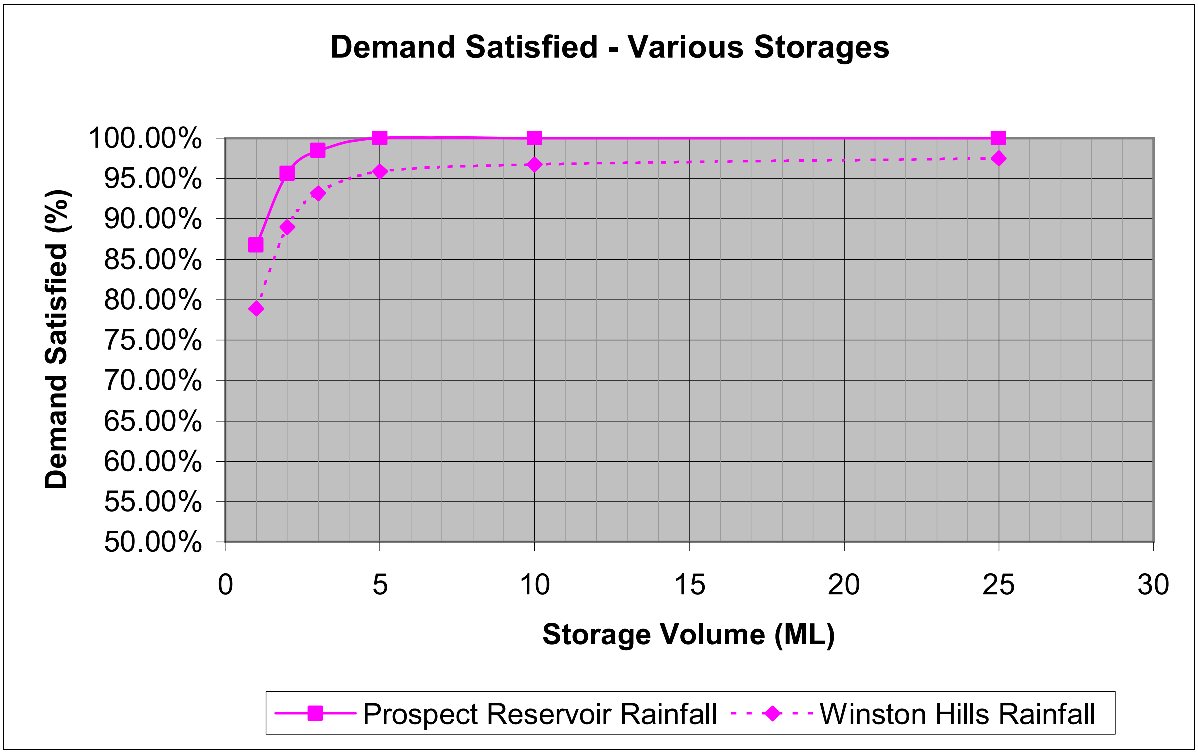
The pump rates used in the simulations were selected as follows:

- 1.84L/s is equivalent to 58ML/year based on continuous pumping for 24 hours a day, every day of the year. This is the minimum pump rate used in all of the simulations.
- 9.3 L/s is the combined rate of the Golf Course and Boral Recycling, which, subsequent to discussions with Boral, is no longer requried. This is the maximum pump rate used in the simulations.
- 5L/s and 7L/s were used as intermediate pump rates between the golf course and the combined Golf Course and Boral Recycling pump rates.

4.2 Scenario 1 – Storage Pond Optimisation

In order to optimise the balancing pond volume, a range of volumes (1, 2, 3, 5, 10 & 25 ML) were simulated, assuming a constant pump rate. The pump rate used was set to the golf course demand, which is equivalent to 1.84L/s assuming continuous operation. Results from the simulations were compared and reported in the graphs below. Detailed results are provided in Appendix A.

Figure 3 Storage Pond optimisation – 1.84 L/s Pump Rate



Demand satisfied represents the amount of water supplied as a portion of the demand for the same. The graph shows that:

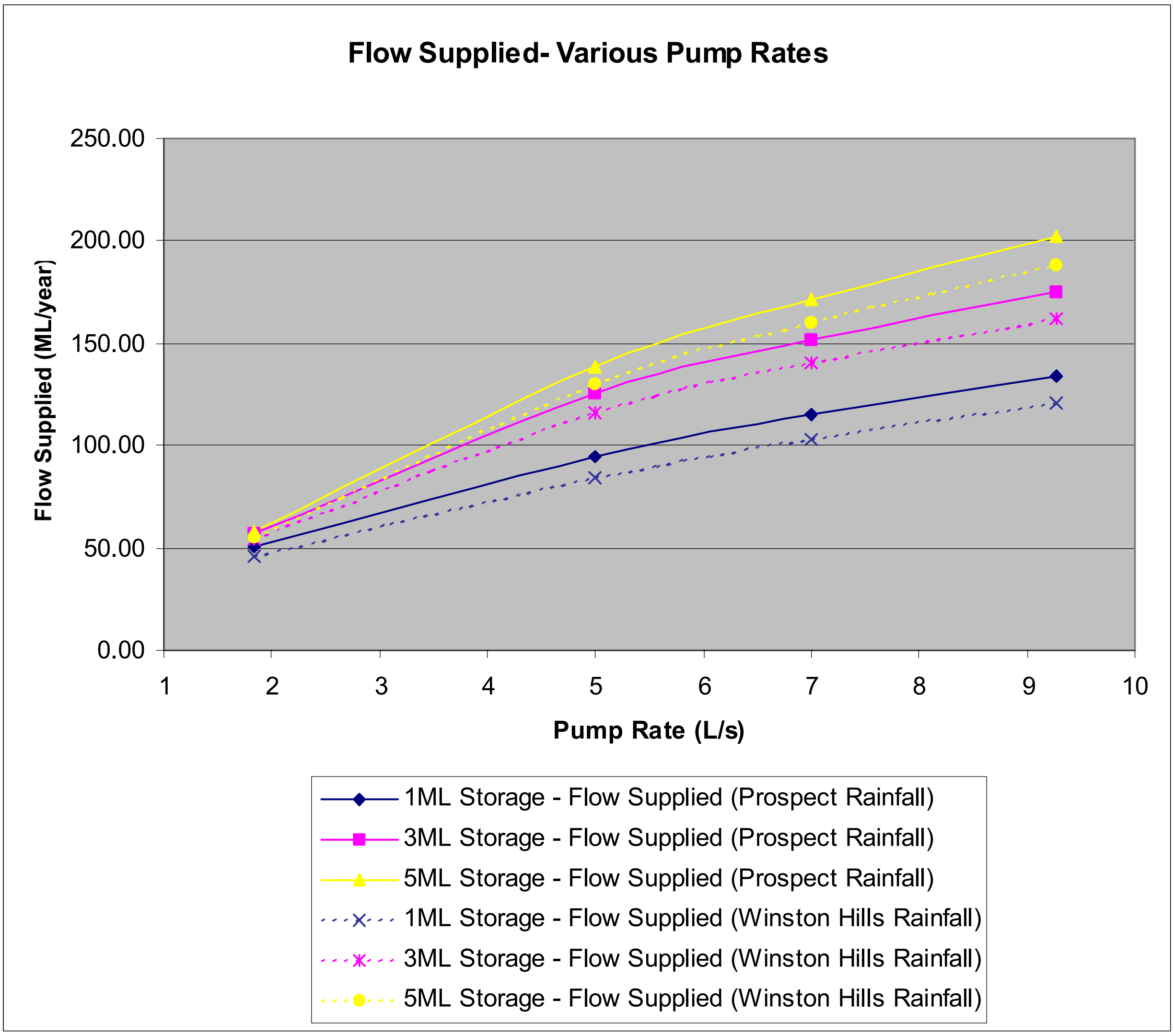
- Approximately 85% of the demand is supplied in the case of a 1 ML balancing pond. The demand satisfied increases with balancing pond volume;
- The curves 'flatten' out as the balancing pond volume increases. This demonstrates 'diminishing returns', as pond volumes are increased; and
- The greatest increase in demand satisfied is seen between a 2 and 5 ML balancing pond volume.

4.3 Scenario 2 – Varying Pump Rate

For these simulations, the balancing pond volume was held constant and the pump rate varied, with the minimum being the golf course demand (1.84L/s) and the maximum at 9.3L/s (which is the combined pump rate for the Boral Recycling demand and the golf course demand). Intermediate pump rates of 5L/s and 7L/s were also simulated. Three balancing pond volumes of 1 ML, 3 ML and 5 ML were considered for this scenario.

The results from these simulations are given in the graphs below:

Figure 4 Pump Rate Comparison



The figure shows that:

- With increasing balancing pond volume, the volume of demand supplied increases; and
- With increasing pump rate, the volume of demand supplied increases; and
- The rate of increase of demand supplied decreases as the pump rate increases, resulting in diminishing returns.

4.4 Sensitivity Assessment - Modified Duration Simulation

Additional simulations were undertaken for recent rainfall data (01/01/1999 to 30/04/2004) to represent recent drought years. Scenario 1 & 2 options were simulated, and the results for these simulations are presented below:

Figure 5 Modified Duration Pond Optimisation – 1.84 L/s Pump Rate

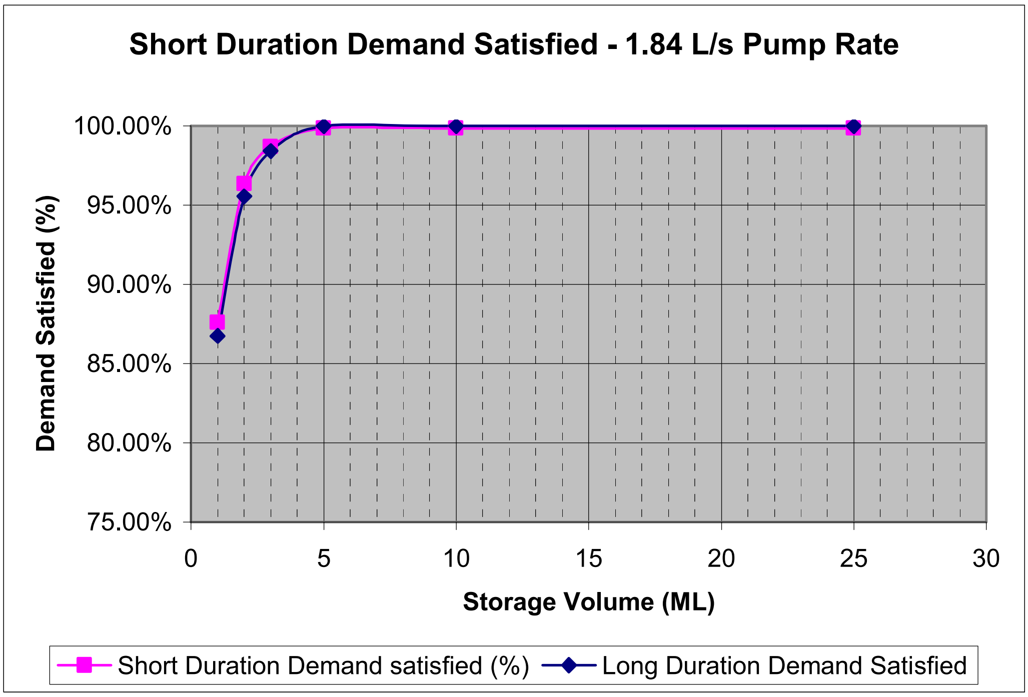
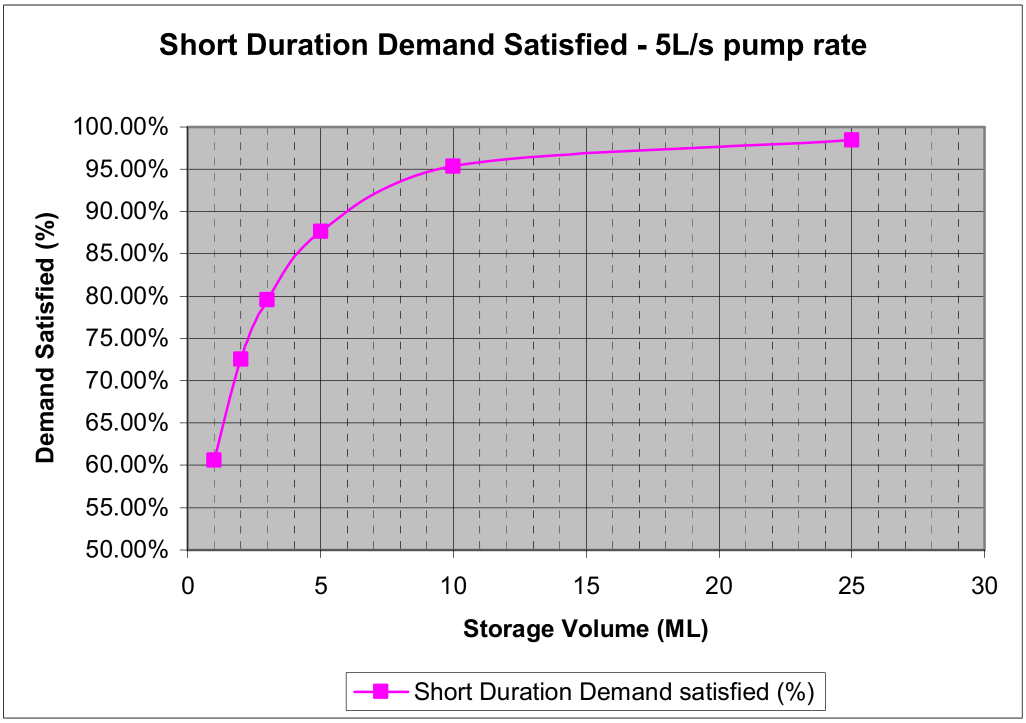


Figure 6 Modified Duration Pond Optimisation – 5 L/s Pump Rate



The graph shows that:

- A slightly higher "demand satisfied" (approximately 87% of the demand) is obtained in the case of 1.84L/s pump rate of a 1 ML balancing pond. The demand satisfied increases with balancing pond volume, and close to 100% of the demand is satisfied for a 5 ML pond of 1.84 L/s pump rate.
- Similar rates are demonstrated in the case of 5L/s pump rate, with the short time (drought years) "demand satisfied" approximately 61% of the total demand of a 1 ML balancing pond. The demand satisfied increases with the increase in pond volume and close to 87% is satisfied for a 5 ML pond.
- The curves again 'flatten' out as the balancing pond volume increases. This demonstrates 'diminishing returns', as the pond volumes are increased; and
- The greatest increase in demand satisfied is seen between a 1 and 5 ML balancing pond volume.

The results show that in order to combat the effect of short duration demands ie like the recent drought years, it would be recommended to increase the balancing pond volume to between 2 and 5 ML, for a increase in the confidence of the water supply.

5. Concept Design

Following the recommendations of the water balance assessment, three concept designs were developed for the 1 ML, 3ML and 5ML balance storage volumes.

The proposed balance storages have all been incorporated within the Widemere East detention basin and are separated from the main detention basin by an embankment wall of approx. 5m in height with embankments at 1(V) in 3(H) and an access track running along the top of the embankment.

The stormwater runoff from the development site drains into a diversion pit where the low-flows (ie 3-month flows) are directed to the balance storage area. The groundwater flows from the collection system are also diverted into the pump well at a lower level.

The design allows for a pump well arrangement to be located within the area adjacent to the access road for the Widemere East precinct. The groundwater collection discharges into the pump well at a level lower than the outlet pipe from the invert of the water harvest storage basin, the outlet pipe from the water harvest basin will also have a non-return valve this will eliminate the potential for any cross contamination between the groundwater and stormwater. – Refer to Appendix B for further details.

Following receipt of GHD's concept designs for the 3 water balance storage options (1, 3 & 5 ML volumes) Currie & Brown (C&B) have undertaken a construction cost estimate for the works. C&B revealed that the actual volume of the water-harvesting pond stored was irrelevant with regards to the actual construction costing of the proposal (as all that changes are the locations of the embankment wall not the infrastructure to generate the additional storage volumes). C&B calculated that the approximate additional costing involved in the construction of Water Harvesting proposal is $400,000.00.

6. DNR Licensing Requirements

A Department of Natural Resources (DNR) Groundwater Extraction License will be a required as part of the groundwater drainage management associated with the SEL subdivision. This licence is not incorporated in any way to the Stormwater Harvesting and Re-use proposal.

Preliminary discussions with Mr. Brain Graham from DNR have indicated that a licence will be required for the Stormwater Harvesting and Re-use proposal. DNR have suggested that unlike the DNR Groundwater Extraction licence, the Stormwater Re-use Licence will most likely be issued to the end user of the harvested water, in which case CCGC would be responsible for the submission of the licence application. DNR have yet to set licence requirements for the Stormwater Harvesting and Re-use proposal, and have requested a submission to be provided describing the proposed activity to assist with the assessment/licensing process.

7. Summary and Conclusions

- This report is a preliminary investigation into the water balance strategy for the proposed development at the Greystanes development;
- An EPA SWMM model was compiled for the site and configured to simulate at a daily time step for approximately 35 years of rainfall data. The model was used to simulate the water balance at the site including runoff from the SEL site, proposed balancing pond and golf course demand;
- Two scenarios were considered for the simulations. These were as follows:
  - Scenario 1: Constant pump rate and varying balancing pond volume; and
  - Scenario 2: Constant balancing pond volume and varying pump rate.
- For Scenario 1, a range of balancing pond volume (1, 2, 3, 5, 10 & 25 ML) was simulated at each lot. Key findings were:
  - Approximately 85% of the demand is supplied in the case of a 1 ML balancing pond volume. The demand satisfied increases with balancing pond volume;
  - The curves 'flatten' out as the balancing pond volume increases. This demonstrates 'diminishing returns', as balancing pond volume are increased; and
  - The greatest increase in demand satisfied is seen between a 2 and 5 ML storage pond.
- For Scenario 2, a range of pump rates were simulated while the storage volume was held constant. Key findings were:
  - With increasing balancing pond volume, the demand supplied increases; and
  - With increasing pump rate, the volume of demand supplied increases; and
  - The rate of increase of demand supplied decreases as the pump rate increase, resulting in diminishing returns.
- Sensitivity simulations for the recent drought period confirm similar trends showing that the effect would be to increase the assured supply, and that a balancing pond volume of between 2 and 5 ML would be appropriate.

8. Recommendations

As a result of the water balance analysis, we recommend to incorporate a water balance storage basin of between 2 and 5 ML, preferably 5ML as this will ensure an adequate supply over a longer period of time. The pump out rate that is to be adopted is dependant on the storage and demand requirements of the CCGC at the time of pumping. The analysis does demonstrate that by pumping at a higher rate we can exceed the average rate of 58ML/year (minimum demand as provided by CCGC). Pumping at a continuous rate of 5L/s will exceed the ultimate CCGC's demand of 130ML/year.

This analysis does not consider the CCGC ability to receive and store the pumped runoff. The model should be expanded to include CCGC catchment and on-site storages.

Appendix A

SWMM Results

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.011)
--------------------------------------------------------------


****************
Analysis Options
****************
Flow Units ............... LPS
Infiltration Method ...... CURVE_NUMBER
Flow Routing Method ...... DYNWAVE
Starting Date ............ JAN-01-1998 00:00:00
Ending Date .............. APR-30-2004 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Wet Time Step ............ 00:15:00
Dry Time Step ............ 00:15:00
Routing Time Step ........ 900.00 sec


*************
Element Count
*************
Number of rain gages ...... 2
Number of subcatchments ... 6
Number of nodes ........... 3
Number of links ........... 2
Number of pollutants ...... 0
Number of land uses ....... 0


****************
Raingage Summary
****************
                                        Data        Interval
Name                Data Source         Type           hours
------------------------------------------------------------
Boral               Boral               VOLUME         24.00
Prospectreservoir   prospectreservoir   VOLUME         24.00


********************
Subcatchment Summary
********************
Name                       Area     Width   %Imperv    %Slope    Rain Gage             Outlet
--------------------------------------------------------------------------------------------------
Batter-west               11.10    333.00     70.00   30.0000    Boral                 Basin
West                      22.82    477.70     85.00    1.0000    Boral                 Basin
East                      49.18    700.00     85.00    1.0000    Boral                 Basin
Batter-east               17.50    420.00     70.00   30.0000    Boral                 Basin
SWD4+DB5+node1            10.96    316.00     30.00    9.9600    Boral                 Basin
Roads                      8.40    100.00     90.00    0.5000    Boral                 Basin


************
Node Summary
```

****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
Out-15	OUTFALL	-1.00	1.50	0.0	
Demand	OUTFALL	5.00	0.00	0.0	
Basin	STORAGE	0.00	1.50	0.0	Yes

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
demandpump	Basin	Demand	TYPE2 PUMP			
overflow	Basin	Out-15	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow

************************** Runoff Quantity Continuity **************************	Volume hectare-m	Depth mm
Total Precipitation	657.863	5484.106
Evaporation Loss	0.000	0.000
Infiltration Loss	45.102	375.978
Surface Runoff	611.721	5099.459
Final Surface Storage	0.125	1.040
Continuity Error (%)	0.139	

************************** Flow Routing Continuity **************************	Volume hectare-m	Volume Mliters
Dry Weather Inflow	4.792	47.921
Wet Weather Inflow	611.684	6116.905
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	616.175	6161.814
Surface Flooding	0.000	0.000
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.049	

****
Subcatchment Runoff Summary

****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Peak Runoff LPS	Runoff Coeff
Batter-west	5484.106	0.000	0.000	519.996	4943.163	170.420	0.901
West	5484.106	0.000	0.000	260.069	5217.283	350.884	0.951
East	5484.106	0.000	0.000	237.581	5240.579	756.067	0.956
Batter-east	5484.106	0.000	0.000	474.424	4997.947	268.778	0.911
SWD4+DB5+node1	5484.106	0.000	0.000	1102.631	4370.750	167.752	0.797
Roads	5484.106	0.000	0.000	157.604	5321.971	129.201	0.970
System	5484.106	0.000	0.000	375.978	5099.459	1843.102	0.930

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Max Vol. Ponded ha-mm	Total Minutes Flooded
Out-15	OUTFALL	0.00	0.00	-1.00	0 00:00	0	0
Demand	OUTFALL	0.00	0.00	5.00	0 00:00	0	0
Basin	STORAGE	0.65	1.29	1.29	100 02:00	0	0

****
Node Flow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Maximum Flooding Overflow LPS	Time of Max Occurrence days hr:min
Out-15	OUTFALL	0.00	1842.34	100 19:30	0.00	
Demand	OUTFALL	0.00	1.84	73 00:30	0.00	
Basin	STORAGE	1843.34	1843.34	101 00:00	0.00	

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
Basin	0.645	43	1.291	86	100 02:00	1844.18

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow LPS	Max. Flow LPS
Out-15	28.41	103.09	1842.34
Demand	100.00	1.57	1.84
System	64.20	104.66	1844.18

****
Link Flow Summary
****

Link	Type	Maximum Flow LPS	Time of Max Occurrence days hr:min	Maximum Velocity m/sec	Max/ Full Flow	Max/ Full Depth	Total Minutes Surcharged
demandpump	PUMP	1.84	73 00:30		1.00		2767050
overflow	WEIR	1842.34	100 19:30			0.58	0

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	--- Fraction of Time in Flow Class ---- Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Avg. Froude Number	Avg. Flow Change

****
Highest Flow Instability Indexes
****
Link overflow (7)

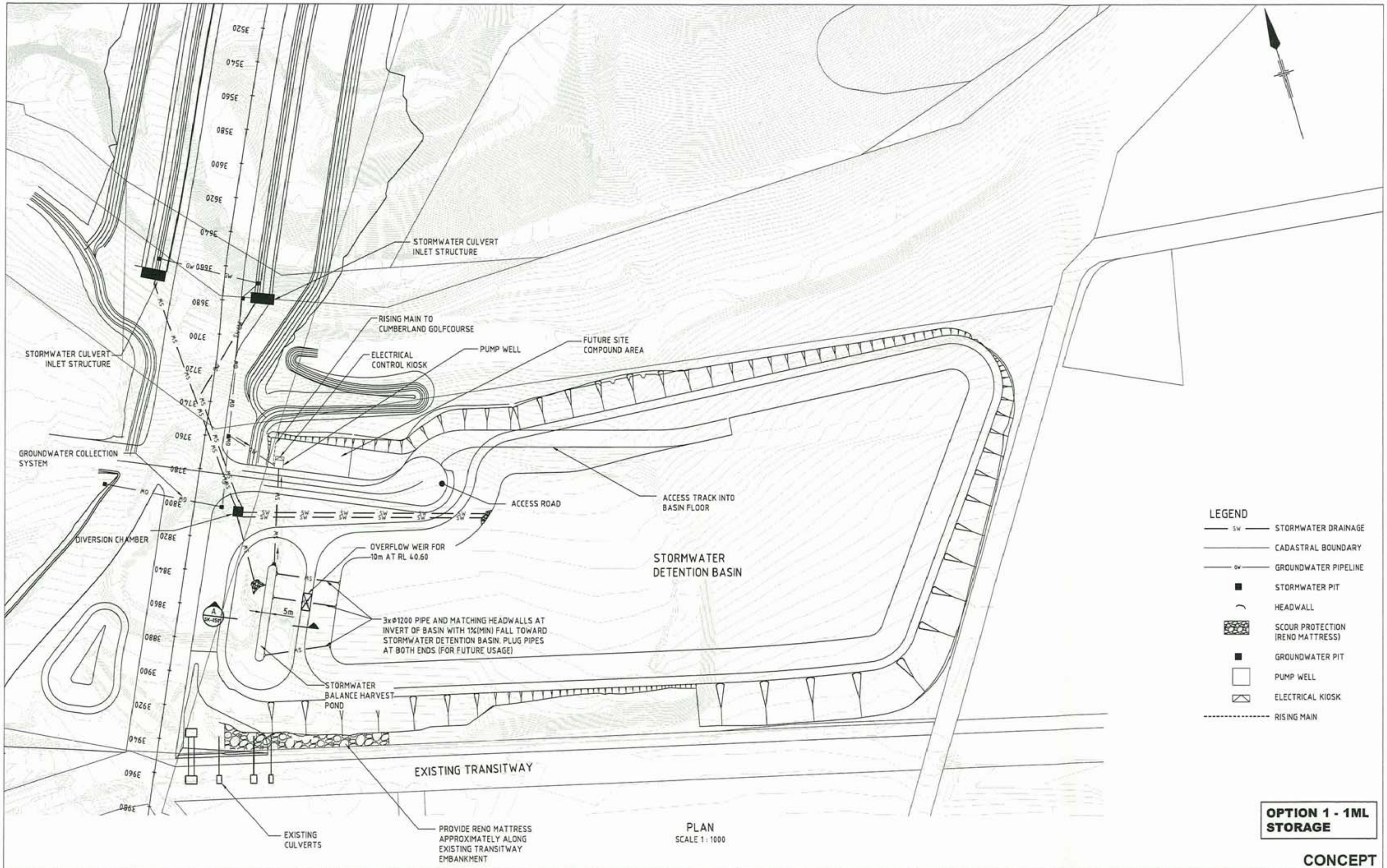
****
Routing Time Step Summary
****

```
Minimum Time Step           :   900.00 sec
Average Time Step           :   900.00 sec
Maximum Time Step           :   900.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.06
```

```
Analysis begun on:  Fri Aug 10 16:02:25 2007
Analysis ended on:  Fri Aug 10 16:02:44 2007
Total elapsed time: 00:00:19
```

Appendix B

Concept Works Drawings



PLAN
SCALE 1 : 1000

OPTION 1 - 1ML STORAGE

CONCEPT

No	Revision	Drawn	Checked	Approved	Date
B	DESIGN CHAGNES FOLLOWING MEETING	VT			26-07-07
A	CONCEPT DESIGN ONLY	VT			25-07-07

Note: * indicates signatures on original issue of drawing or last revision of drawing

SCALE 1:500 AT ORIGINAL SIZE (0 5 10 15 20 25m)

SCALE 1:1000 AT ORIGINAL SIZE (0 10 20 30 40 50m)

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DO NOT SCALE

Drawn	V.THIAGARAJAH	Designed	F.CARROZZA
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

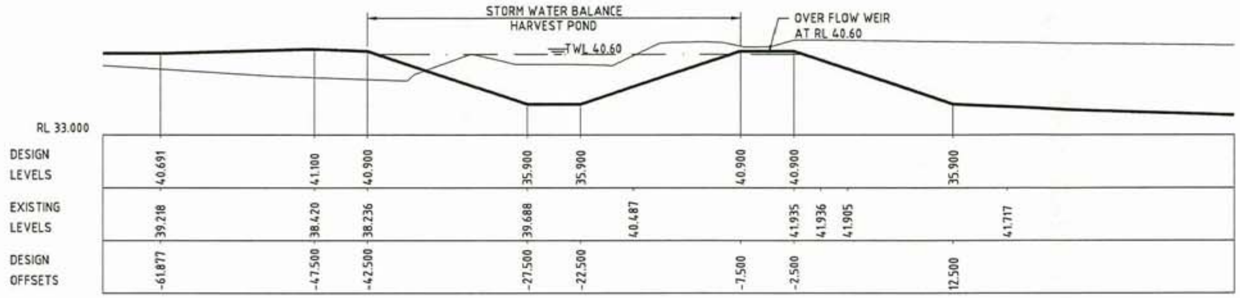
Client: BORAL RECYCLING PTY. LTD.
Project: GREYSTANES ESTATE SEL
Title: CUMBERLAND GOLF COURSE WATER BALANCE ASSESSMENT GENERAL PLAN

Original Size: A1 Drawing No: **21-15443-SK-0501** Rev: B

Plot Date: 9 August 2007 - 1:58 PM Cad File No: G:\21\15443\CADD\Drawings\21-15443-SK-0501.dwg

LEGEND

- DESIGN SURFACE LEVEL (thick line)
- NATURAL SURFACE (thin line)



TYPICAL CROSS SECTION - OPTION 1

SECTION A-A

Scales Hor 1:250 Ver 1:250

OPTION 1 - 1ML STORAGE

CONCEPT

No	Revision	Drawn	Checked	Approved	Date
C	BORAL COMMENTS AMENDED	VT			30-07-07
B	DESIGN CHANGES FOLLOWING MEETING	VT			26-07-07
A	CONCEPT DESIGN ONLY	VT			25-07-07

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0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

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Drafting Check | Design Check
Approved
Date
Scale AS SHOWN

Client **BORAL RECYCLING PTY. LTD.**
Project **GREYSTANES ESTATE SEL**
Title **CUMBERLAND GOLF COURSE**
WATER BALANCE ASSESSMENT TYPICAL SECTION

Original Size A1 Drawing No: **21-15443-SK-0502** Rev: C

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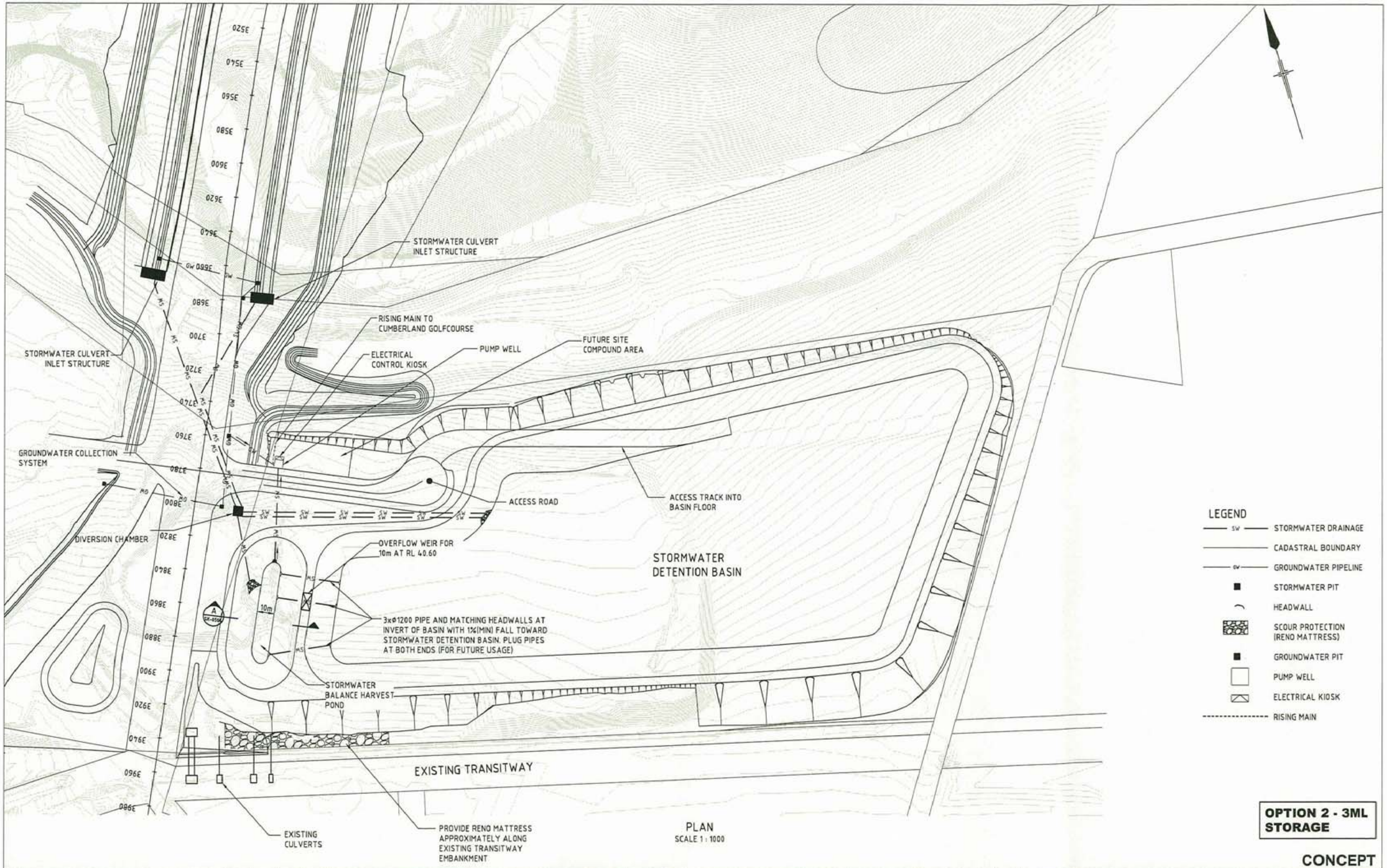

PLAN
SCALE 1 : 1000

OPTION 2 - 3ML STORAGE

CONCEPT

No	Revision	Drawn	Checked	Approved	Date
B	DESIGN CHAGNES FOLLOWING MEETING	VT			26-07-07
A	CONCEPT DESIGN ONLY	VT			25-07-07

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0 5 10 15 20 25m SCALE 1:500 AT ORIGINAL SIZE

0 10 20 30 40 50m SCALE 1:1000 AT ORIGINAL SIZE

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Title **CUMBERLAND GOLF COURSE WATER BALANCE ASSESSMENT GENERAL PLAN**

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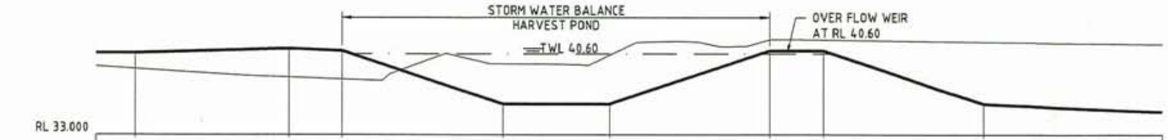
LEGEND

━━━━	DESIGN SURFACE LEVEL
────	NATURAL SURFACE



DESIGN LEVELS	40.691	41.100	40.900	35.900	35.900	40.900		40.900	35.900
EXISTING LEVELS	39.218	38.420	38.236	39.688	40.487	41.935	41.936	41.905	41.717
DESIGN OFFSETS	-61.877	-47.500	-42.500	-27.500	-17.500	-2.500		2.500	17.500

TYPICAL CROSS SECTION - OPTION 2

SECTION A-A

Scales Hor 1:250 Ver 1:250

OPTION 2 - 3ML STORAGE

CONCEPT

No	Revision	Drawn	Checked	Approved	Date
B	DESIGN CHAGNES FOLLOWING MEETING	VT			26-07-07
A	CONCEPT DESIGN ONLY	VT			25-07-07

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

BORAL

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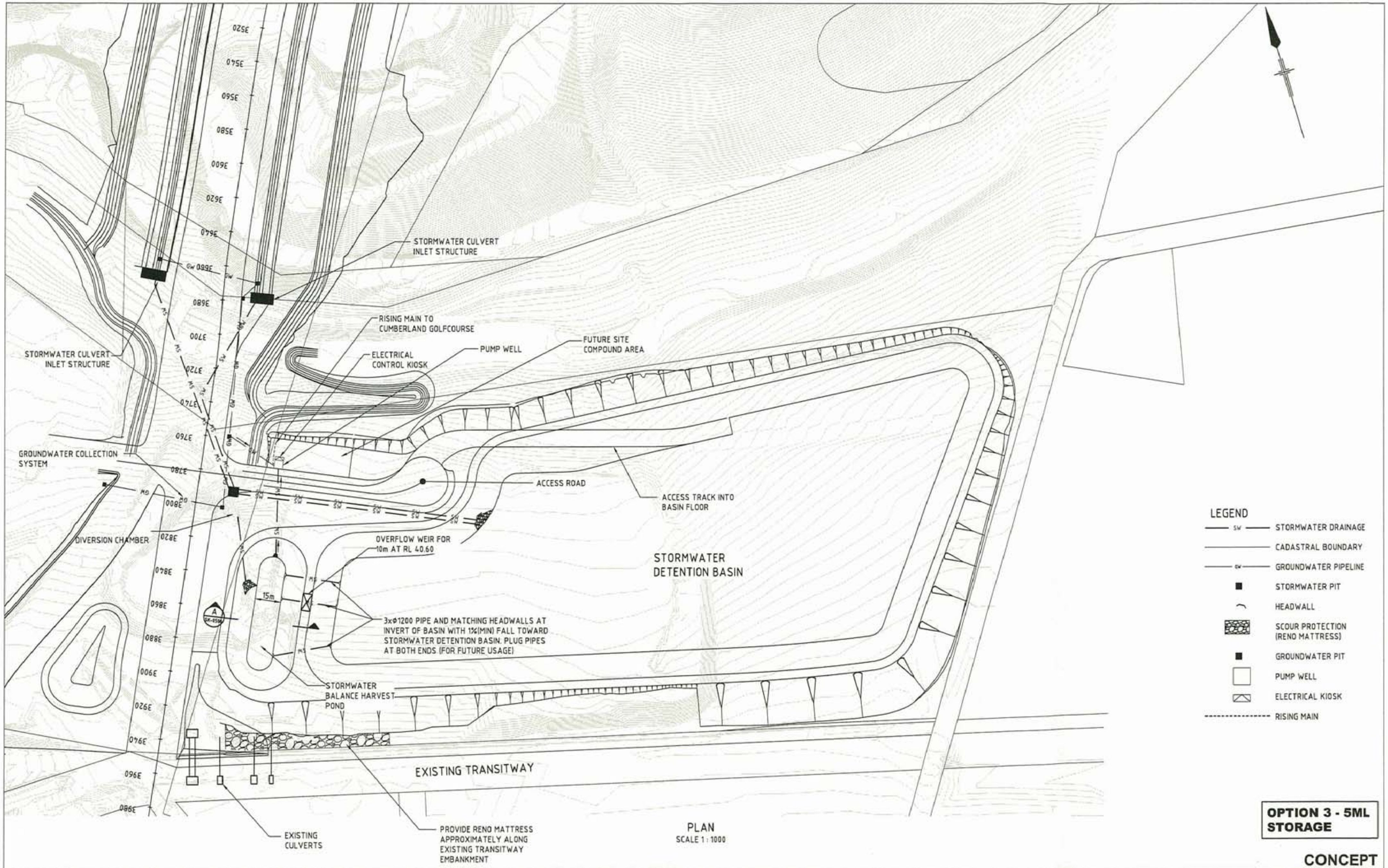
Drawn V.THIAGARAJAH | Designed F.CARROZZA
Drafting Check | Design Check
Approved
Date
Scale AS SHOWN
This Drawing must not be used for Construction unless signed as Approved

Client **BORAL RECYCLING PTY. LTD.**
Project **GREYSTANES ESTATE SEL**
Title **CUMBERLAND GOLF COURSE WATER BALANCE ASSESSMENT TYPICAL SECTION**
Original Size A1 Drawing No: **21-15443-SK-0504** Rev: **B**

Plot Date: 9 August 2007 - 1:58 PM Cad File No: G:\21\15443\CADD\Drawings\21-15443-SK-0504.dwg



PLAN
SCALE 1:1000

OPTION 3 - 5ML STORAGE

CONCEPT

No	Revision	Drawn	Checked	Approved	Date
B	DESIGN CHAGNES FOLLOWING MEETING	VT			26-07-07
A	CONCEPT DESIGN ONLY	VT			25-07-07

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 5 10 15 20 25m — SCALE 1:500 AT ORIGINAL SIZE

0 10 20 30 40 50m — SCALE 1:1000 AT ORIGINAL SIZE

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Drawn V.THIAGARAJAH | Designed F.CARROZZA
Drafting Check | Design Check
Approved
Date
Scale AS SHOWN | This Drawing must not be used for Construction unless signed as Approved

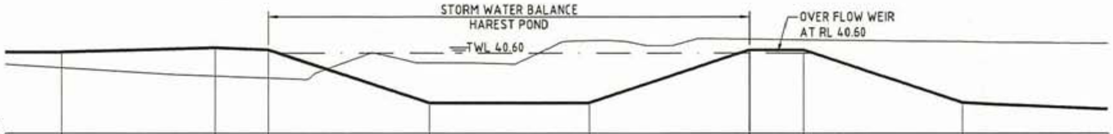
Client **BORAL RECYCLING PTY. LTD.**
Project **GREYSTANES ESTATE SEL**
Title **CUMBERLAND GOLF COURSE WATER BALANCE ASSESSMENT GENERAL PLAN**

Original Size A1 Drawing No: **21-15443-SK-0505** Rev: B

Plot Date: 9 August 2007 - 1:59 PM Cad File No: G:\21\15443\CADD\Drawings\21-15443-SK-0505.dwg

LEGEND

(thick line)	DESIGN SURFACE LEVEL
(thin line)	NATURAL SURFACE



DESIGN LEVELS	40.691	41.100	40.900	35.900		35.900			40.900	40.900		35.900
EXISTING LEVELS	39.218	38.420	38.236	39.688	40.487		41.935	41.936	41.905		41.717	
DESIGN OFFSETS	-61.877	-47.500	-42.500	-27.500		-12.500			2.500	7.500		22.500

TYPICAL CROSS SECTION - OPTION 3
SECTION A-A
Scales Hor 1:250 Ver 1:250

OPTION 3 - 5ML STORAGE

CONCEPT

No	Revision	Drawn	Checked	Approved	Date
C	BORAL COMMENTS AMENDED	VT			30-07-07
B	DESIGN CHANGES FOLLOWING MEETING	VT			26-07-07
A	CONCEPT DESIGN ONLY	VT			25-07-07

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0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

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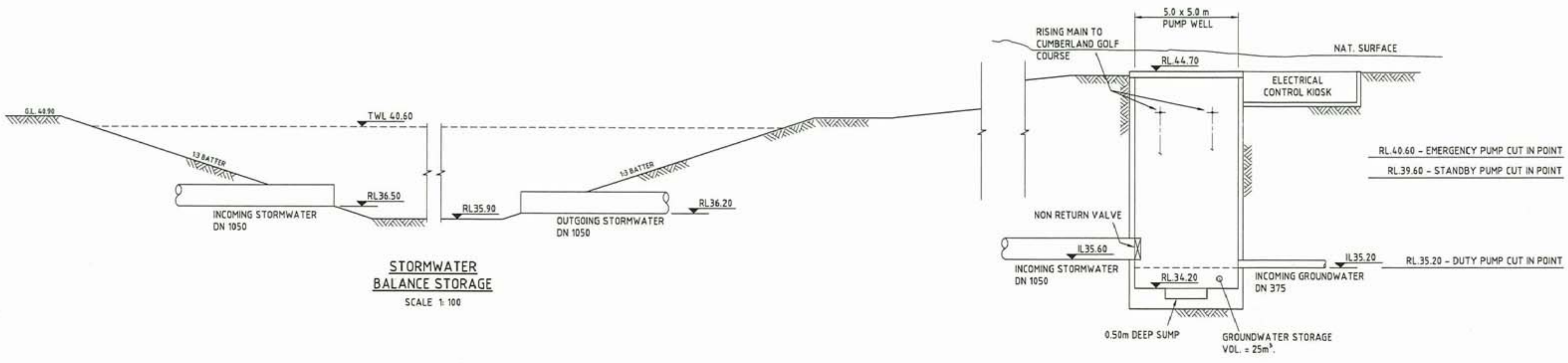
Drawn	V.THIAGARAJAH	Designed	F.CARROZZA
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client BORAL RECYCLING PTY. LTD.
Project GREYSTANES ESTATE SEL
Title CUMBERLAND GOLF COURSE
WATER BALANCE ASSESSMENT TYPICAL SECTION

Original Size A1 Drawing No: 21-15443-SK-0506 Rev: C

Plot Date: 9 August 2007 - 1:59 PM Cad File No: G:\21\15443\CADD\Drawings\21-15443-SK-0506.dwg



STORMWATER BALANCE STORAGE

SCALE 1: 100

PUMP WELL CHAMBER

SCALE 1: 100

CONCEPT

No	Revision	Drawn	Checked	Approved	Date
B	DESIGN CHANGES FOLLOWING MEETING	VT			26-07-07
A	CONCEPT DESIGN ONLY	LGH			25-07-07

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0 1 2 3 4 5m

SCALE 1:100 AT ORIGINAL SIZE

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Drawn	L. HONEYSETT	Designed	F.CARROZZA
Drafting Check		Design Check	
Approved			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: BORAL RECYCLING PTY. LTD.

Project: GREYSTANES ESTATE SEL

Title: CUMBERLAND GOLF COURSE WATER BALANCE ASSESSMENT - SCHEMATIC ELEVATION PLAN

Original Size: A1 Drawing No: 21-15443-SK-0507 Rev: B

Plot Date: 9 August 2007 - 1:58 PM Cad File No: G:\21\15443\CADD\Drawings\21-15443-SK-0507.dwg

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
1	J.Maslem	R.Berg		R.Berg		
2	J.Maslem	R.Berg		R.Berg		
3	F. Carrozza	F. Carrozza	#	T. Irga	#	23/8/07